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A Preliminary Report on the Effects of Ultraviolet Irradiation on the Gibberellic Acid Solutions

By

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With 3 Figures

Introduction

It has always been a difficult problem to sterilize gibberellic acid (GA_3) solutions to be used as components of culture media or in some biological tests such as barley endosperm bioassay. Autoclaving is known to be an unreliable means of sterilization for GA_3 since this treatment reduces its biological activity to a great degree (HILLMAN 1960, BRAGT & PIERIK 1971). The effects of ultraviolet irradiation on this plant hormone has not been studied in detail to our present knowledge, whereas the detrimental effects of this treatment on auxins are well established (BRAUNER 1953). In the present investigation we attempted to investigate the effects of ultraviolet irradiation on the biological activity and spectrophotometric properties of gibberellic acid in order to establish the degree of reliability of UV-sterilizing of this substance.

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Materials and Methods

Gibberellic acid (courtesy of the Lilly Labs., USA) was dissolved in distilled water and 25 ml 50 ppm GA_3 solutions in 9 cm diameter petri dishes with the lid removed were irradiated throughout the experiments. The ultraviolet source used was a Philips low pressure mercury vapour lamp (Philips type Nr. 93109, arch length 40 mm, wattage 15). The distance between the solution and UV source was measured to be 23 cm. The concentration change due to evaporation was found to be insignificant (in the order

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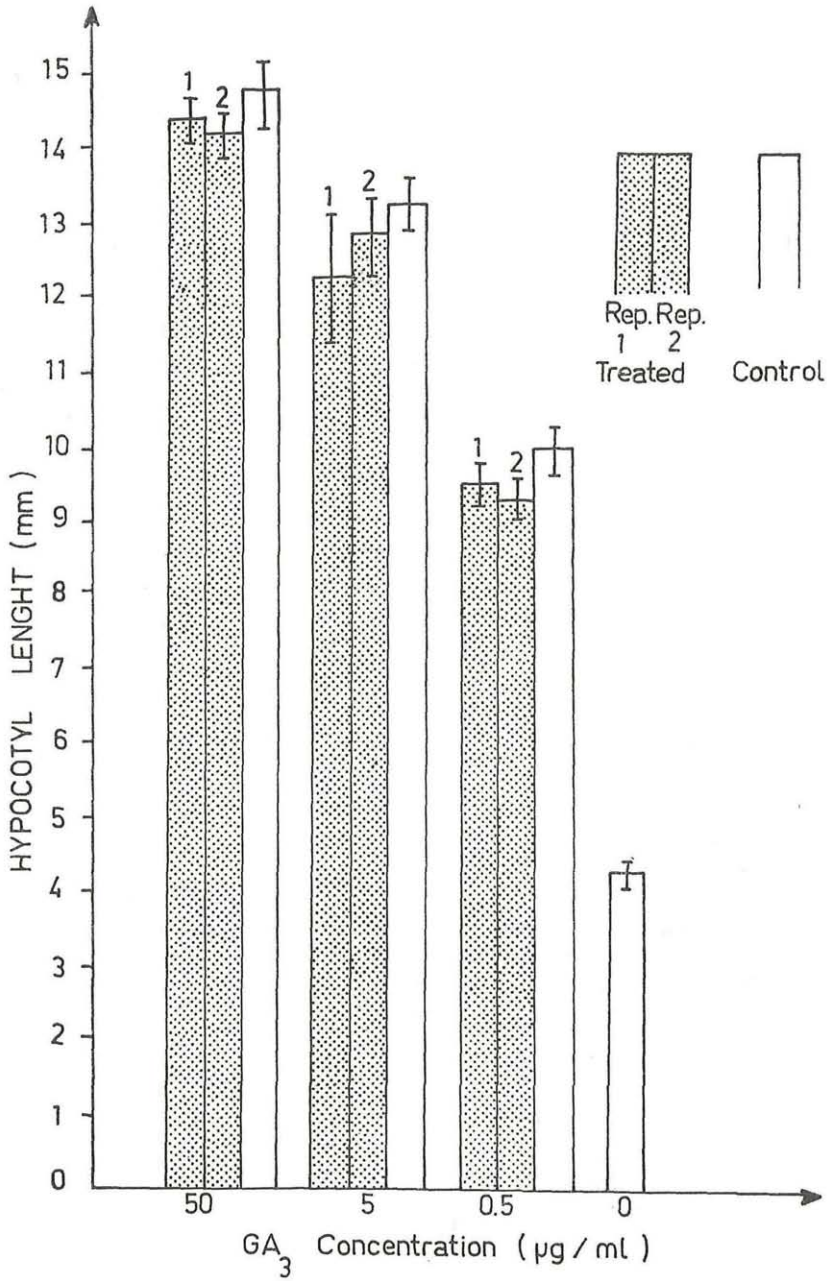

Fig. 1. The activities in the lettuce hypocotyl growth bioassay of UV-Treated or untreated gibberellic acid solutions (50 ppm) and of their dilutions (5 and 0.5 ppm). Vertical bars represent the standard errors of the means. Ten seedlings were used per disc. Irradiation duration: 80 min. Further explanation in the text.

of 1 ppm) and after the irradiation was terminated, the small amount of water evaporated was added to the solution to maintain the original concentration. In order to perform the lettuce hypocotyl test used to check the biological activity of GA_3, lettuce (cv. Yedikule) was sterilized with 1% sodium hypochloride solution and sown on moist filter paper in petri dishes and kept in darkness. 40 hours later, germinated seeds were selected for uniformity and transferred into petri dishes containing filter paper moistened with 5 ml of test solution. The dishes with seedlings were placed unter diffuse fluorescent light (app. 4300 lumens per square foot). After 49 hours of continuous illumination the length of hypocotyls were measured. The scanning of GA_3 solutions was done with a Beckman DB-GT spectrophotometer.

Biological tests and irradiations were performed at 26° C.

Results and Discussion

The solution irradiated for 80 minutes was diluted and the original solution and dilutions (50, 5.0, 0.5 ppm) were tested for activity with the

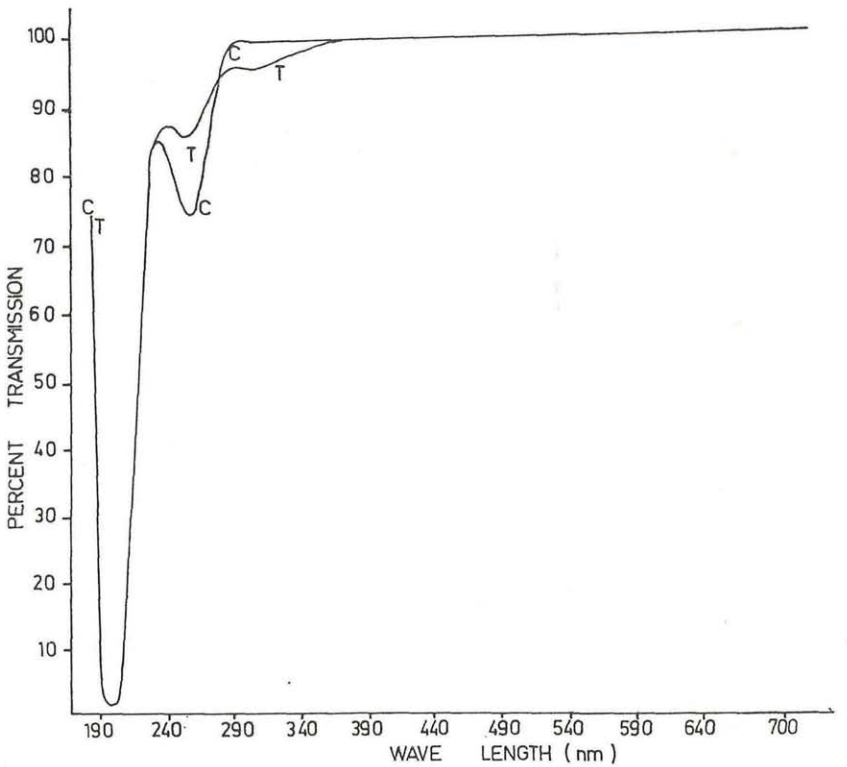

Fig. 2. Transmission curves of UV-irradiated (T) and control (C) solutions of GA_3 (50 ppm). Irradiation duration: 80 min.

lettuce hypocotyl bioassay. The treated solution and its dilutions were tested in two replicates, the control in one replicate. Experiment was repeated three times with constistent results and a representative occassion is depicted in Fig. 1. Here it can be seen that there is no significant difference between the biological activities of the treated and control solutions.

On the other hand, the solution irradiated likewise was scanned between 190—700 μm and the transmission curves of the treated and control

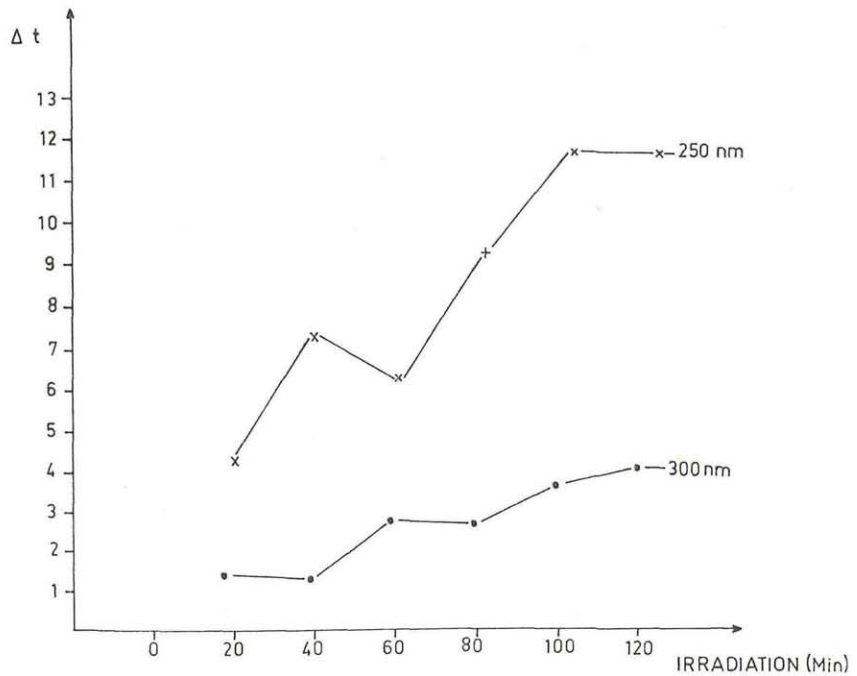

Fig. 3. Δ t (difference between the transmission curves at 250 and 300 nm) of irradiated and control GA_3 solutions (50 ppm) as dependent on increasing irradiation durations.

solutions were compared. In Fig. 2 it can be seen that upon irradiation, the transmission curve of GA_3 was modified at 250 and 300 μm. Finally, GA_3 solution was irradiated for various durations (20, 40, 60, 80, 100, 120 min.) and the difference between the transmission curves of treated and untreated solutions = Δt- at 250 and 300 μm was determined. Fig. 3 shows that the change in the spectrophotometric properties of GA_3 solutions irradiated with UV seems to be somewhat time- dependent, reaching a saturation point at a certain dosage of irradiation.

In conclusion we can say that UV treatment can not be considered a good means of sterilization of GA_3 because this treatment seems to alter the

spectrophotometric properties, hence the molecular structure. On the other hand, the biological activity, at least for lettuce bioassay, is not affected significantly by this treatment. This may as well mean that gibberellic acid is converted into another GA-like substance, a conversion well known in the case of red light (REID & al. 1972). The identity of the new GA-like substance and its activity in other gibberellin bioassays needs to be investigated. Work to this end is well in progress.

Summary

The effect of ultraviolet irradiation on the gibberellic acid (GA_3) solutions was investigated. The results indicated that this treatment does not alter the biological activity of GA_3, but modifies its spectrophotometric properties.

Zusammenfassung

Durch das Einwirken von UV-Strahlen auf Gibberellinsäure (GA_3)-Lösungen werden nicht die biologische Aktivität, sondern nur die spektrophotometrischen Eigenschaften der GA_3 beeinflußt.

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